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(54) HIGH FLOW SURFACE MOUNT COMPONENTS

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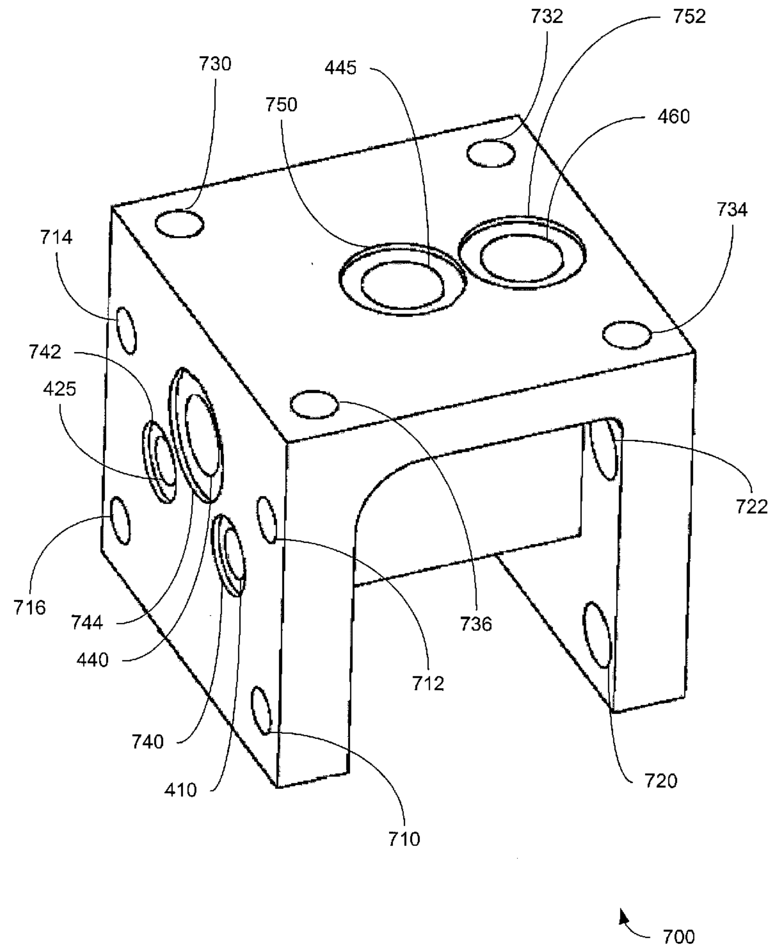
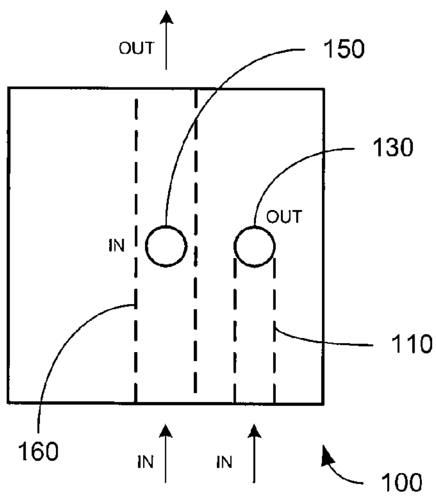
(52) **U.S. Cl.** **137/884**

(57) **ABSTRACT**

A modular fluid handling system is disclosed and may include a plurality of fluid handling units. Adjacent fluid handling units may be coupled together to form the fluid handling system. The fluid handling system may deliver fluid from at least one fluid source to fluid utilizing equipment. A plurality of fluid passages may be formed from the coupled plurality of fluid handling units, where the diameter of at least one fluid passage may be greater than the diameter of at least one other fluid passage.

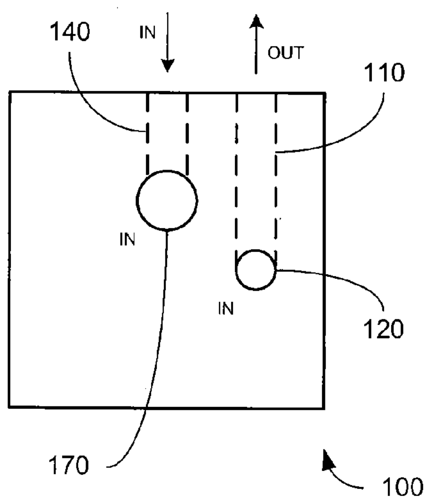


ISOMETRIC VIEW



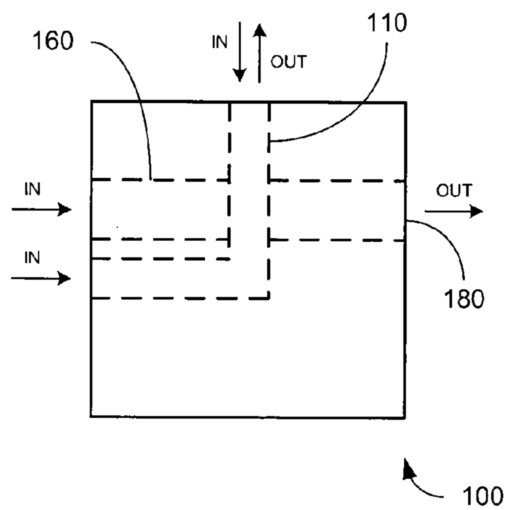
TOP VIEW

Fig. 1A



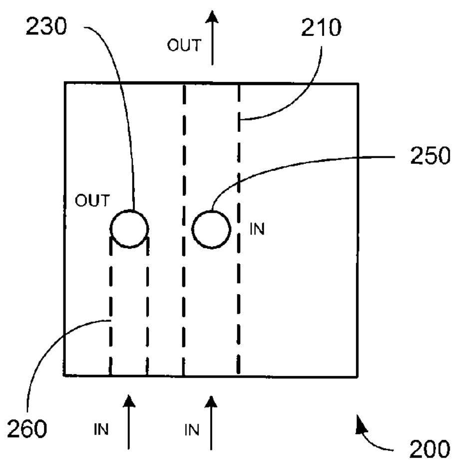
FRONT VIEW

Fig. 1B



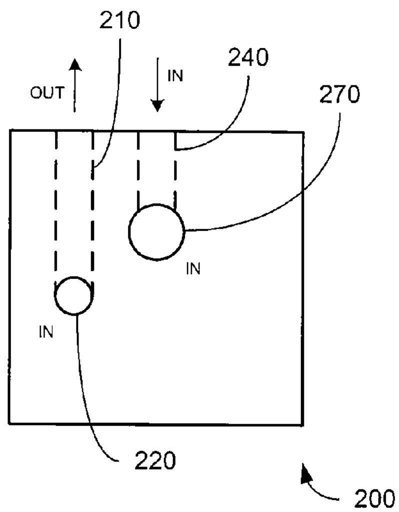
SIDE VIEW

Fig. 1C



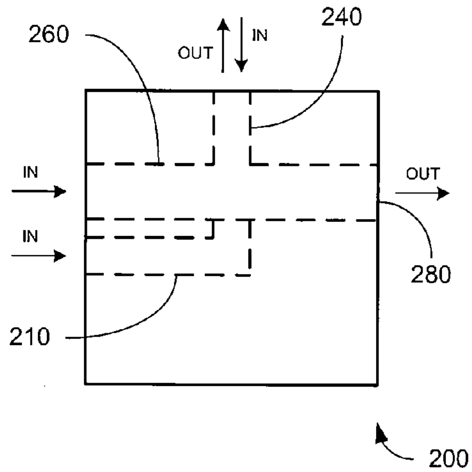
TOP VIEW

Fig. 2A



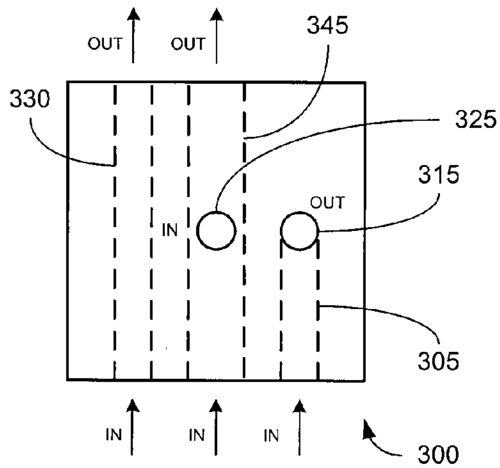
FRONT VIEW

Fig. 2B

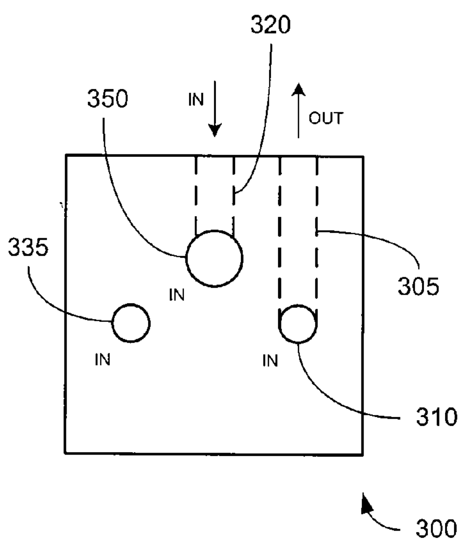


SIDE VIEW

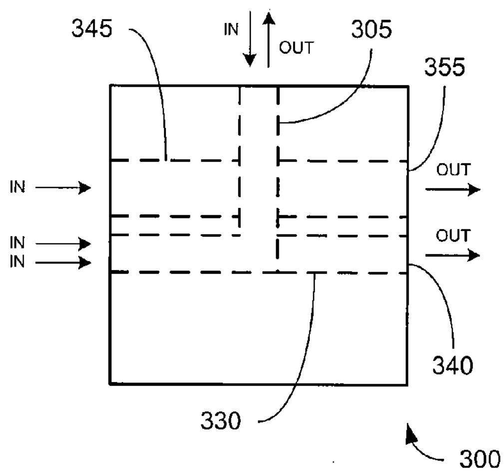
Fig. 2C



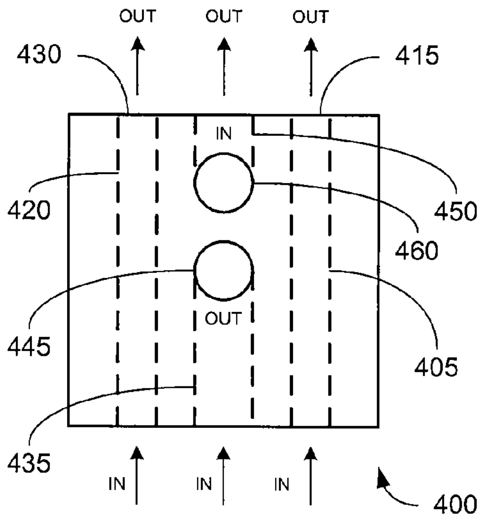
TOP VIEW
Fig 3A



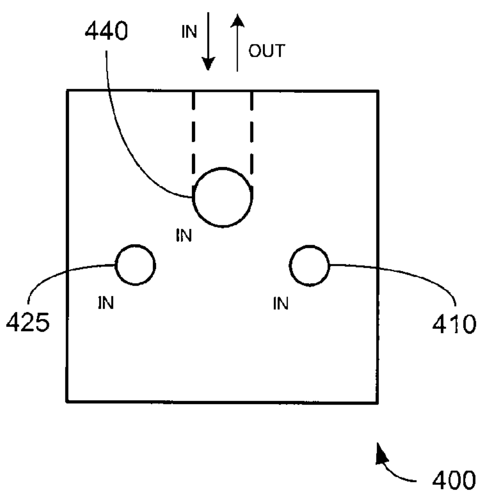
FRONT VIEW
Fig. 3B



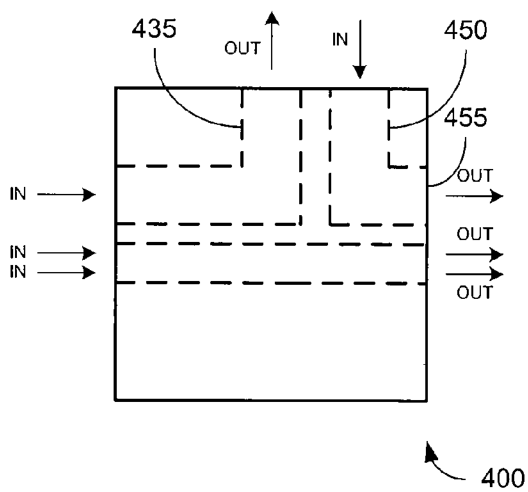
SIDE VIEW
Fig. 3C



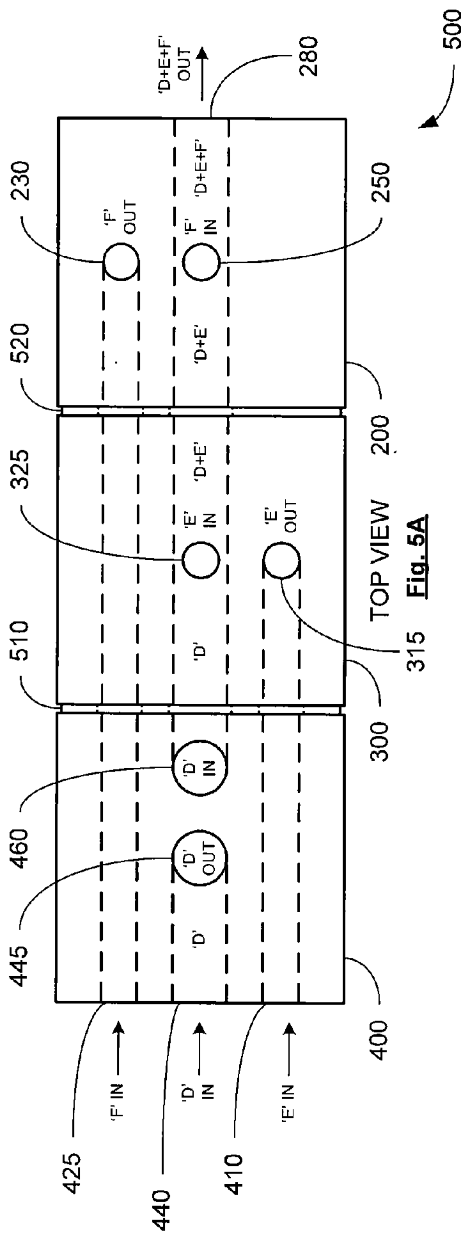
TOP VIEW
Fig. 4A



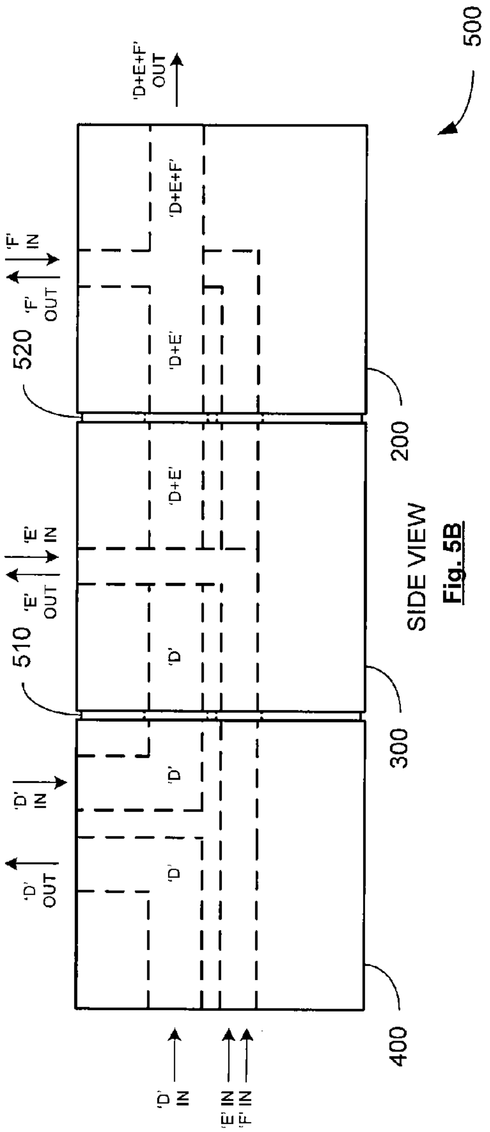
FRONT VIEW
Fig. 4B



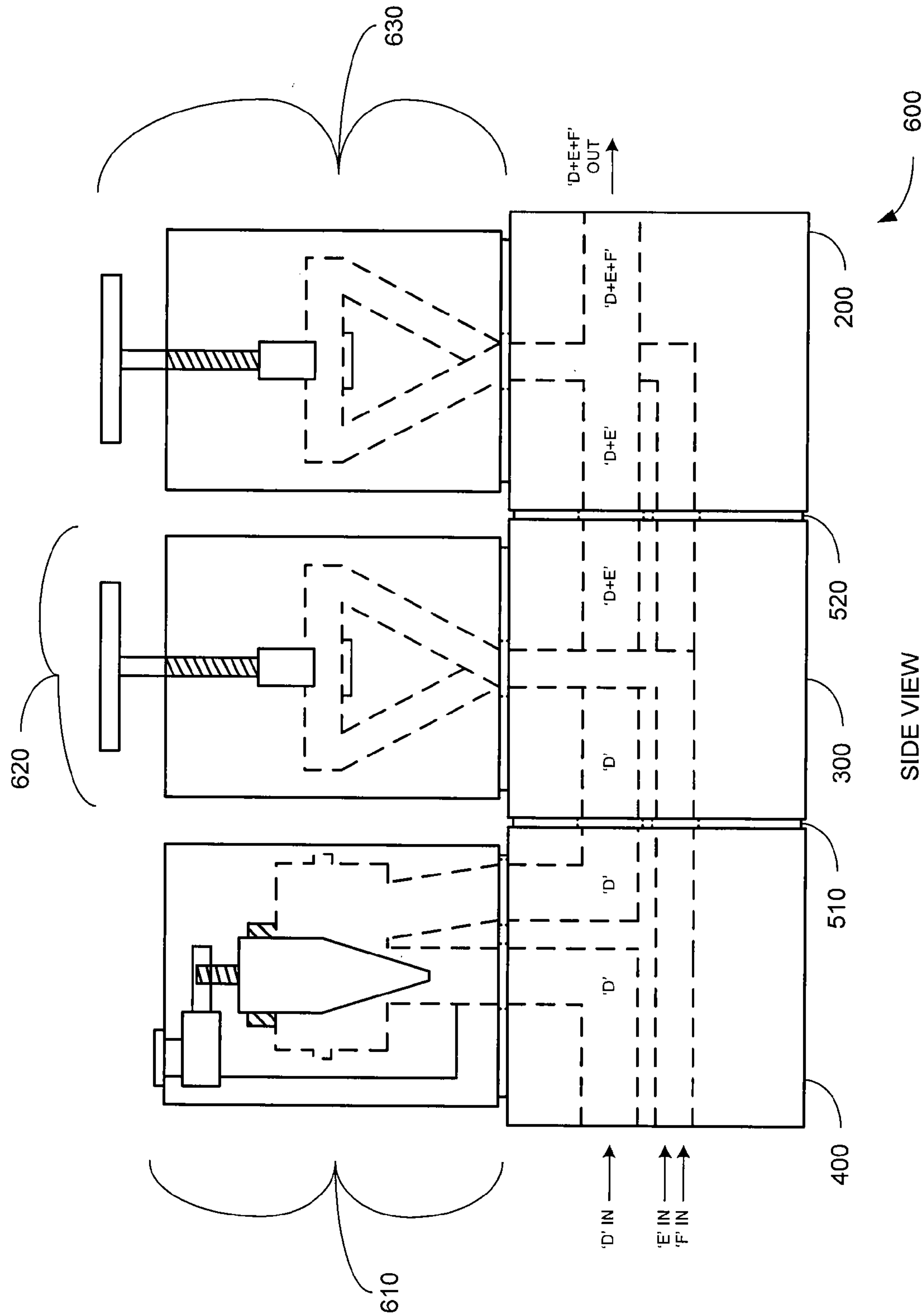
SIDE VIEW
Fig. 4C



TOP VIEW
Fig. 5A

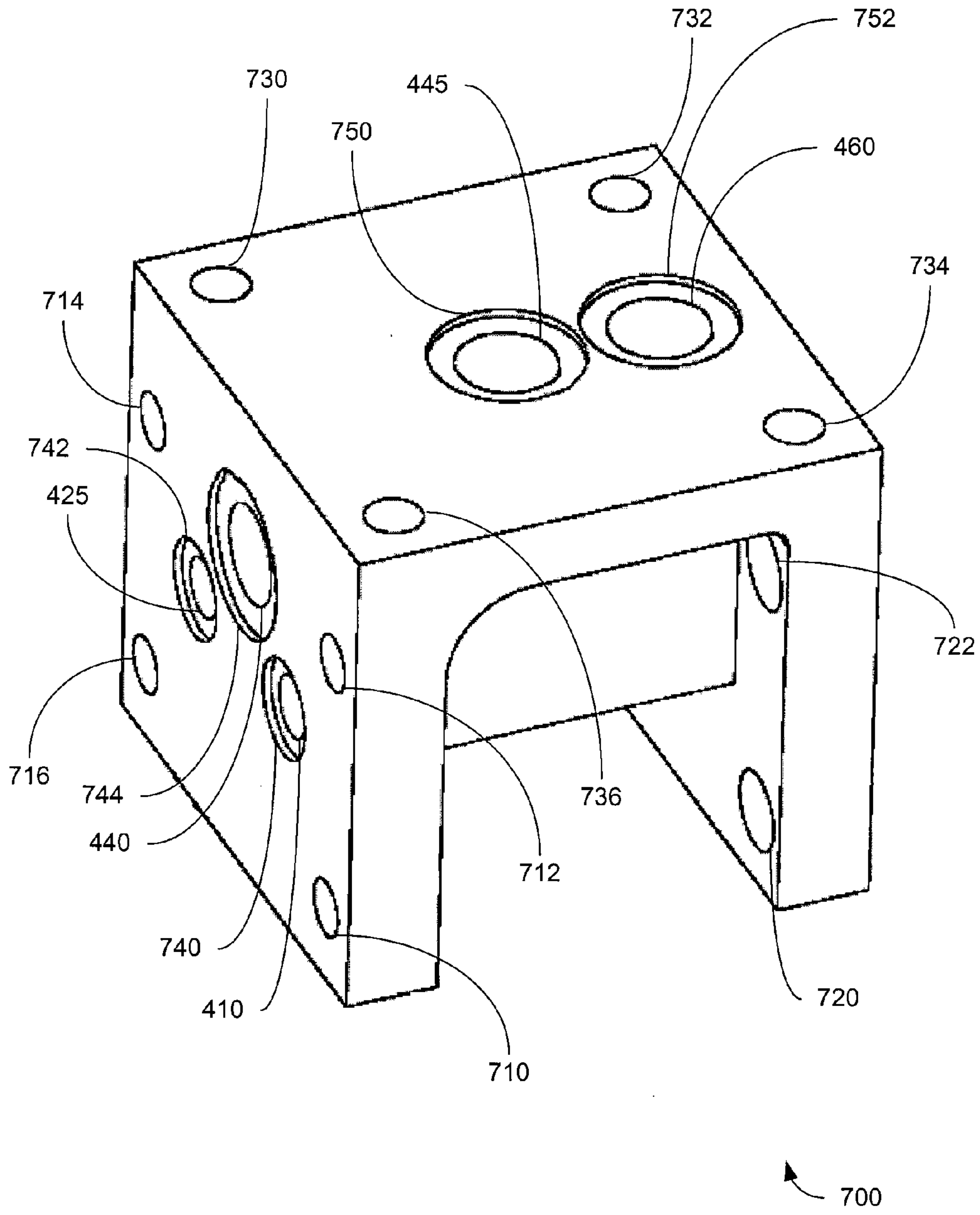


SIDE VIEW
Fig. 5B



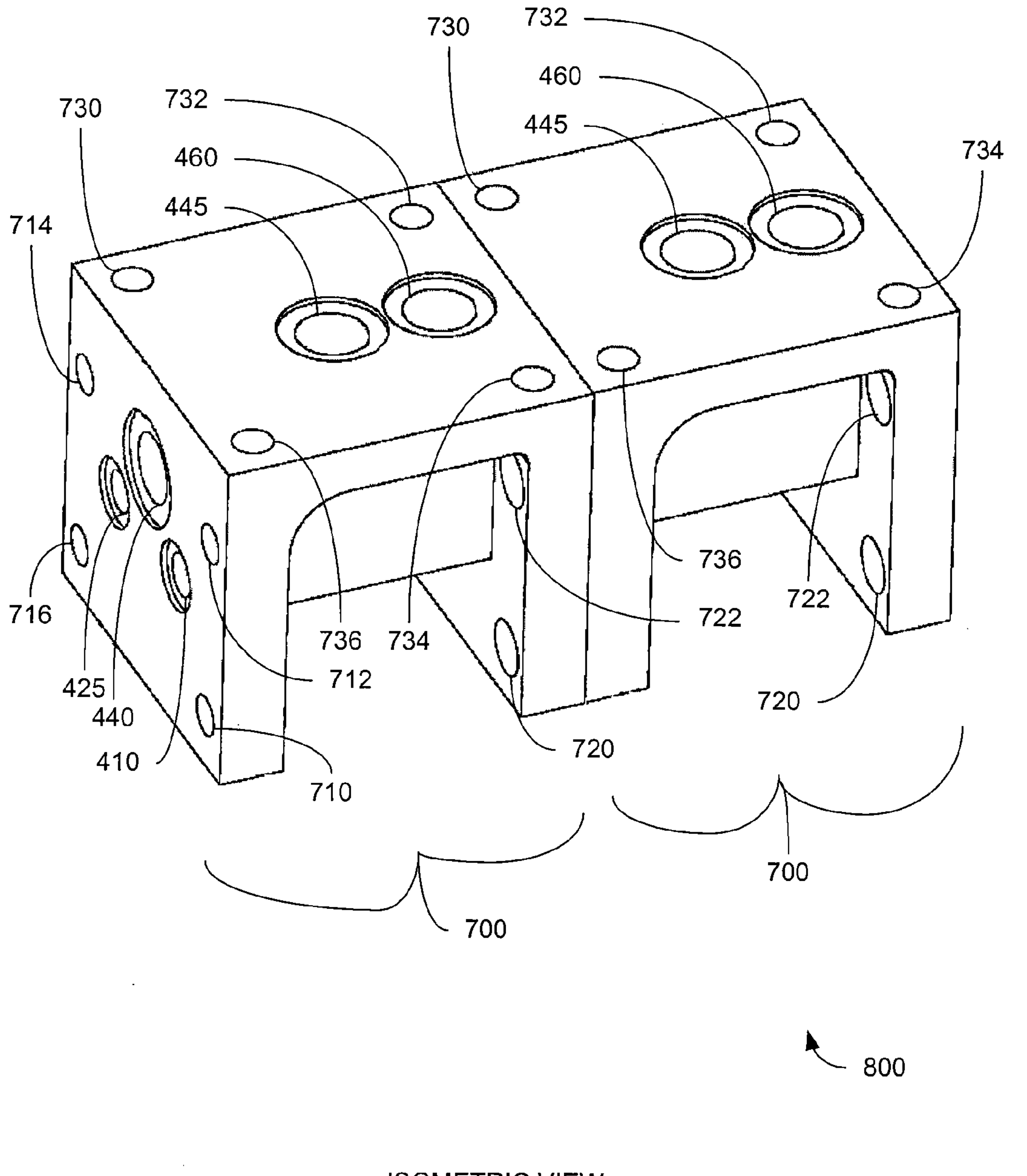
SIDE VIEW

Fig. 6



ISOMETRIC VIEW

Fig. 7



ISOMETRIC VIEW

Fig. 8

HIGH FLOW SURFACE MOUNT COMPONENTS

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is a divisional application of U.S. patent application Ser. No. 11/424,815, filed Jun. 16, 2006, the disclosure of which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND OF THE INVENTION

[0002] Typically, fluid sources and fluid utilizing equipment are connected to each other using fluid handling assemblies. These assemblies allow for control, regulation, and mixing of fluids which are delivered to fluid utilizing equipment. Conveniently, these systems are modular so they may be easily constructed and employ industry standard control components. Typical assemblies known in the art are discussed in U.S. Pat. No. 6,298,881, entitled "MODULAR FLUID HANDLING ASSEMBLY AND MODULAR FLUID HANDLING UNITS WITH DOUBLE CONTAINMENT" to William J. Curran et al. and U.S. Pat. No. 6,283,155, entitled "SYSTEM OF MODULAR SUBSTRATES FOR ENABLING THE DISTRIBUTION OF PROCESS FLUIDS THROUGH REMOVABLE COMPONENTS" to Kim Ngoc Vu.

[0003] However, these, and other modular systems are limited in their capabilities because they only allow for regulation of one size of fluid stream, or combination of multiple similar sized streams into another similar sized stream. This can result in combined streams with excessive pressures. As a solution, non-modular components may be used to allow combinations of multiple similar sized streams into a larger sized stream formed by the non-modular components. These systems may avoid the pressure increases associated with the wholly modular systems which provide configurations using only one size stream, but have several disadvantages.

[0004] Non-modular components are more likely to leak because of the fabrication processes involved in assembling the non-modular components together, and to standardized modular components. Additionally, such constructions take up more space, and require a greater and varied stock of non-standardized replacement parts for common maintenance, which may not be used to replace faulty modular components within other parts of such fluid handling systems. This results in increased maintenance and repair costs to fluid handling systems which translates to increased possible downtime and disruption to revenue producing equipment.

BRIEF SUMMARY OF THE INVENTION

[0005] In one embodiment, a fluid handling unit is provided. The fluid handling unit may include a body, a plurality of fluid passage ports formed in the body, and a plurality of orifices formed on surfaces of the body to provide fluid access to the ports from outside the unit. At least two of the orifices may have different cross-sectional areas. The fluid handling unit may have a front face, a back face, and a top face. There may be one or more input orifices on the front face of the body, one or more output orifices on the back face of the body, and one or more control orifices on the top face of the body. The top face of the body may be adapted to be reversibly coupled with a control component having at least one component orifice. The front face of the body of the first fluid handling unit may be adapted to be reversibly coupled with a back face of a body of a second fluid handling unit. The back face of the body of the first fluid handling unit may be adapted to be reversibly coupled with a front face of a body of a second fluid handling unit.

[0006] In another embodiment, a modular fluid handling system is provided. The fluid handling system may include a plurality of fluid handling units, wherein adjacent fluid handling units may be coupled together to form the fluid handling system. The fluid handling system may deliver fluid from at least one fluid source to fluid utilizing equipment. A plurality of fluid passages may be formed from the coupled plurality of fluid handling units and the diameter of at least one fluid passage may be greater than the diameter of at least one other fluid passage. At least one control component may be coupled with at least one of the fluid handling units.

[0007] In another embodiment, a fluid delivery manifold is provided. The fluid delivery manifold may include a plurality of fluid handling units, wherein adjacent fluid handling units may be coupled together to form the fluid delivery manifold. The fluid delivery manifold may deliver fluid from a plurality of fluid sources to a piece of fluid utilizing equipment. A high-flow fluid passage may be coupled with the fluid utilizing equipment and possibly be formed by two or more of the fluid handling units. A plurality of low-flow fluid passages may be in fluid communication with the high-flow fluid passage and the plurality of fluid sources, wherein the low-flow fluid passages may be formed by two or more of the fluid handling units and have a smaller diameter than the high-flow fluid passage. At least one control component may be coupled with each of the low-flow fluid passages, wherein the control component may regulate a rate of fluid flow from the low-flow fluid passages to the high-flow passage.

[0008] In another embodiment, a different fluid delivery manifold is provided. The fluid delivery manifold may include a plurality of fluid handling units, wherein adjacent fluid handling units may be coupled together to form the fluid delivery manifold. The fluid delivery manifold may deliver fluid from a fluid source to a plurality of pieces of fluid utilizing equipment. A high-flow fluid passage may be coupled with the fluid source and possibly be formed by two or more of the fluid handling units. A plurality of low-flow fluid passages may be in fluid communication with the high-flow fluid passage and the plurality of pieces of fluid utilizing equipment, wherein the low-flow fluid passages may be formed by two or more of the fluid handling units and have a smaller diameter than the high-flow fluid passage. At least one control component may be coupled with each of the low-flow fluid passages, wherein the control component may regulate a rate of fluid flow to the low-flow fluid passages from the high-flow fluid passage.

[0009] Additional embodiments and features are set forth in part in the description that follows, and in part will become apparent to those skilled in the art upon examination of the specification or may be learned by the practice of the invention. The features and advantages of the invention may be realized and attained by means of the instrumentalities, combinations, and methods described in the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention is described in conjunction with the appended figures:

[0011] FIG. 1A shows a top view of one possible fluid handling unit of the invention having a first small fluid passage port accessible by an input orifice and a control orifice; a second small fluid passage port accessible by a control orifice; and a large fluid passage port accessible by an input orifice and an output orifice, and in fluid communication with the second small fluid passage port;

[0012] FIG. **1**B shows a front view of the fluid handling unit of FIG. **1**A;

[0013] FIG. **1**C shows a side view of the fluid handling unit of FIG. **1**A and FIG. **1**B;

[0014] FIG. **2**A shows a top view of another possible fluid handling unit of the invention similar to that shown in FIG. **1**A, except with the first small fluid passage port in a different position within the fluid handling unit;

[0015] FIG. **2**B shows a front view of the fluid handling unit of FIG. **2**A;

[0016] FIG. **2**C shows a side view of the fluid handling unit of FIG. **2**A and FIG. **2**B;

[0017] FIG. **3**A shows a top view of another possible fluid handling unit of the invention similar to that shown in FIG. **1**A, except also having a third small fluid passage port proceeding through the fluid handling unit from an input orifice to an output orifice;

[0018] FIG. **3**B shows a front view of the fluid handling unit of FIG. **3**A;

[0019] FIG. **3**C shows a side view of the fluid handling unit of FIG. **3**A and FIG. **3**B;

[0020] FIG. **4**A shows a top view of another possible fluid handling unit of the invention having a first small fluid passage port accessible by an input orifice and an output orifice; a second small fluid passage port accessible by an input orifice and an output orifice; a first large fluid passage port accessible by an input orifice; and a second large fluid passage port accessible by an output orifice;

[0021] FIG. **4**B shows a front view of the fluid handling unit of FIG. **4**A;

[0022] FIG. **4**C shows a side view of the fluid handling unit of FIG. **4**A and FIG. **4**B;

[0023] FIG. **5**A shows a top view of a modular fluid handling system which includes the fluid handling units from FIG. **2**C, FIG. **3**C, and FIG. **4**C coupled together to form a plurality of fluid flow passages;

[0024] FIG. **5**B shows a side view of the modular fluid handling system of FIG. **5**A;

[0025] FIG. **6** shows a side view of the modular fluid handling system of FIG. **5**A with control components attached;

[0026] FIG. **7** shows an isometric view of another possible fluid handling unit of the invention similar to that shown in FIG. **4**A, FIG. **4**B and FIG. **4**C, except having extensions with cavities on the front, back and top of the fluid handling unit that allow for reversible coupling of the fluid handling unit to other fluid handling units, as well as recesses for mechanical seals; and

[0027] FIG. **8** shows an isometric view of two of the fluid handling units from FIG. **7** situated in an orientation as they may be coupled together in some embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Fluid handling units are described for assembling modular fluid handling systems capable of handling and controlling the flow of fluids. The fluids handled and controlled may be liquids or gases. In some applications, fluids used for the fabrication of semi-conductors or other electronic devices may be handled and controlled by the modular fluid handling systems. The modular fluid handing systems may deliver fluids from one or more fluid sources to one or more pieces of fluidizing utilizing equipment, or sub-components thereof. In other embodiments, a modular fluid delivery manifold is described. In some of these embodiments, multiple low-flow fluid streams may be combined into a high-flow fluid stream. In other types of these embodiments, a high-flow fluid stream may be separated into multiple low-flow fluid streams.

[0029] In one embodiment, a fluid handling unit is provided. The fluid handling unit may include a body with a plurality of fluid passage ports formed in the body. In some embodiments the body may be made from a metal such as aluminum; steel; stainless steel or other alloy; a composite such as carbon fiber; ceramic; and/or a polymer or plastic. A plurality of orifices formed on the surfaces of the body may provide fluid access to the ports from outside the unit. At least two of the orifices may have different cross-sectional areas. In some embodiments, the orifices and ports may be generally circular in cross-section and have diameters in the range of about 0.5 inches to about 3.0 inches. In exemplary embodiments, the orifices and ports may be generally circular in cross-section and have diameters in the range of about 0.1 inches to about 1.0 inches. In preferred embodiments, the orifices and ports may be generally circular in cross-section and have diameters in the range of about 0.170 inches to about 0.240 inches. In some embodiments, at least two of the orifices may be circular and have different diameters.

[0030] In various embodiments of the fluid handling unit, the body may have a front face, a back face, and a top face. There may be one or more input orifices on the front face, one or more output orifices on the back face, and one or more control orifices on the top face. At least one of the fluid passage ports may be accessible by the input orifice and the output orifice. At least one of the fluid passage ports may be accessible by the control orifice.

[0031] The top face of the body may be adapted to be reversibly coupled with a control component having at least one component orifice. When the top face of the body is reversibly coupled with the control component, at least one control orifice may be in fluid communication with at least one component orifice. A mechanical seal may be disposed between the first fluid handling unit and the control component to leak tightly couple the first fluid handling unit and the control component. The mechanical seal may be, for example, a chemical adhesive, a chemical sealant, a gasket, an o-ring, a c-ring, a w-seal and/or other metallic seal. Control components may, for example, be such mechanisms as a valve, a flow regulator, a pressure regulator, a restrictive flow orifice, a purifier, a flow controller, a filter, a gauge, a sensor, a branch connector, and/or a mechanical indicator. In some embodiments, control components may have a generally square coupling flange with each side of the square coupling flange being either about 1.5 inches, about 1.25 inches, or about 1.125 inches long. Various coupling methods may be used to couple control components with the body. For example, bolts, nuts, machine screws, threaded cavities, cam-locking mechanisms and/or chemical adhesives are a few of the possible coupling methods. In some embodiments, multiple sets of threaded cavities or other coupling methods may be located on the body so as to allow different sized coupling flanges to be mounted on the same body. For example, through the use of different sets of threaded cavities in a body, different sized control components, possibly with different sized coupling flanges, may be attached to the body by using each of the different sets of threaded cavities.

[0032] The front face of the body of the fluid handling unit may be adapted to be reversibly coupled with a back face of a body of a second fluid handling unit, the secondary fluid handling unit having at least one output orifice. When coupled, at least one input orifice of the fluid handling unit may be in fluid communication with at least one output orifice of the secondary fluid handling unit. A mechanical seal may be disposed between the fluid handling unit and the secondary fluid handling unit to leak tightly couple the fluid handling unit and the secondary fluid handling unit.

[0033] The back face of the body of the fluid handling unit may be adapted to be reversibly coupled with a front face of a body of a secondary fluid handling unit, the secondary fluid handling unit having at least one input orifice. When coupled, at least one output orifice of the fluid handling unit may be in fluid communication with at least one input orifice of the secondary fluid handling unit. A mechanical seal may be disposed between the fluid handling unit and the secondary fluid handling unit to leak tightly couple the fluid handling unit and the secondary fluid handling unit.

[0034] In another embodiment, a modular fluid handling system is described. The modular fluid handling system may include a plurality of fluid handling units, where adjacent fluid handling units may be coupled together to form the fluid handling system. The fluid handling system may deliver fluid from at least one fluid source to fluid utilizing equipment through a plurality of fluid passages which may be formed from the coupled plurality of fluid handling units. The diameter of at least one fluid passage may be greater than the diameter of at least one other fluid passage and at least one control component may be coupled with at least one of the fluid handling units.

[0035] In these embodiments, at least one fluid passage may extend through the plurality of fluid handling units. At least one fluid passage may be in fluid communication with at least one other fluid passage. The fluid communication may occur at least in part through the control component. A mechanical seal may be disposed between adjacent fluid handling units to leak tightly couple adjacent fluid handling units together. At least one fluid passage in these embodiments may be coupled with the fluid source. At least one other fluid passage may be coupled with the fluid utilizing equipment.

[0036] In some embodiments a relatively warm or cold fluid may flow through at least one fluid port and/or fluid passage within the plurality of fluid handling units. These temperate fluids may be intended to warm or cool the other fluids flowing via heat conduction through any one or more of the fluid handling units. Alternatively, these temperate fluids may flow through the plurality of fluid handling units so as to be delivered at a piece of fluid utilizing equipment that utilizes the temperate fluid.

[0037] In another embodiment, a fluid delivery manifold is described. The fluid delivery manifold may include a plurality of fluid handling units, where adjacent fluid handling units may be coupled together to form the fluid delivery manifold. The fluid delivery manifold may deliver fluid from a plurality of fluid sources to a piece of fluid utilizing equipment.

[0038] In these embodiments, a high-flow fluid passage, possibly formed by two or more of the fluid handling units, may be coupled with the fluid utilizing equipment. A plurality of low-flow fluid passages, which may be formed by two or more of the fluid handling units, may be in fluid communication with the high-flow fluid passage and the plurality of fluid sources. The low-flow fluid passages may have a smaller diameter than the high-flow fluid passage. At least one control component may be coupled with each of the low-flow fluid passages, wherein the control component may regulate a rate of fluid flow from the low-flow fluid passage to the high-flow passage.

[0039] In another embodiment, a different fluid delivery manifold is described. The fluid delivery manifold may include a plurality of fluid handling units, where adjacent fluid handling units may be coupled together to form the fluid delivery manifold. The fluid delivery manifold may deliver fluid from a fluid source to a plurality of pieces of fluid utilizing equipment.

[0040] In these embodiments, a high-flow fluid passage, possibly formed by two or more of the fluid handling units, may be coupled with the fluid source. A plurality of low-flow fluid passages, which may be formed by two or more of the fluid handling units, may be in fluid communication with the high-flow fluid passage and the plurality of pieces of fluid utilizing equipment. The low-flow fluid passages may have a smaller diameter than the high-flow fluid passage. At least one control component may be coupled with each of the low-flow fluid passages, wherein the control component regulates a rate of fluid flow to the low-flow fluid passages from the high-flow fluid passage.

[0041] In FIG. **1**A, FIG. **1**B and FIG. **1**C, a fluid handling unit **100** is shown from three different views (top, front and side, respectively). In this embodiment, the fluid handling unit **100** has a first small fluid passage port **110** accessible by an first input orifice **120** and a first control orifice **130**; a second small fluid passage port **140** accessible by a second control orifice **150**; and a large fluid passage port **160** accessible by a second input orifice **170** and an output orifice **180**, and in fluid communication with the second small fluid passage port **140**.

[0042] In one possible application of the fluid handling unit **100**, fluid 'A' flows into input orifice **170**, and fluid 'B' flows into input orifice **120**. The fluids may flow into fluid handling unit **100**, for example, from a fluid source or equipment delivering the fluid from a fluid source, possibly another fluid handling unit. Fluid 'B' will flow from input orifice **120**, through first small fluid passage port **110**, and to first control orifice **130**. A control component may be reversibly coupled to the top of the fluid handling component **100** and may direct and regulate the flow of fluid 'B' from first control orifice **130** to second control orifice **150**. The control component may, for example, be a valve, a flow regulator, a pressure regulator, a restrictive flow orifice, a purifier, a flow controller, a filter, a gauge, a sensor a branch connector and/or a mechanical indicator.

[0043] The regulated flow of fluid 'B' may then flow from second control orifice **150**, through second small fluid passage port **140**, and into large fluid passage port **160** mixing with fluid 'A' to make the mixed fluid 'A+B'. Mixed fluid 'A+B' may then flow through large fluid passage port **160** to output orifice **180**. From the output orifice **180**, the mixed fluid 'A+B' may be delivered, for example, to a piece of fluid utilizing equipment or possibly another fluid handling unit. Those skilled in the art will recognize that because large fluid passage port **160** is larger than small fluid passage port **110**, combining fluids from small fluid passage port **110** into large fluid passage port **160** will produce less pressure in the large fluid passage port **160** than if the combined fluids were mixed into a smaller fluid passage port.

[0044] In FIG. **2**A, FIG. **2**B and FIG. **2**C, a different fluid handling unit **200** is shown from three different views (top, front and side, respectively). This embodiment is similar to that shown in FIG. **1**A, FIG. **1**B and FIG. **1**C, except the first small fluid passage port is in a different location within the body. In this embodiment, the fluid handling unit **200** has a first small fluid passage port **210** accessible by an first input orifice **220** and a first control orifice **230**; a second small fluid passage port **240** accessible by a second control orifice **250**; and a large fluid passage port **260** accessible by a second input orifice **270** and an output orifice **280**, and in fluid communication with the second small fluid passage port **240**.

[0045] In FIG. **3**A, FIG. **3**B and FIG. **3**C, another fluid handling unit **300** is shown from three different views (top, front and side, respectively). This embodiment is similar to that shown in FIG. **1**A, FIG. **1**B and FIG. **1**C, except also having a third small fluid passage port proceeding through the fluid handling unit from an additional input orifice to an additional output orifice. In this embodiment, the fluid handling unit **300** has a first small fluid passage port **305** accessible by a first input orifice **310** and a first control orifice **315**; a second small fluid passage port **320** accessible by a second control orifice **325**; a third small fluid passage port **330** accessible by a second input orifice **335** and a first output orifice **340**; and a large fluid passage port **345** accessible by a third input orifice **350** and a second output orifice **355**, and in fluid communication with the second small fluid passage port **320**. Fluid handling unit **300** allows for similar handling of fluids that fluid handling unit **100** allows, except fluid handling unit **300** also allows for an additional fluid 'C' to be delivered across fluid handling unit **300** without control or regulation.

[0046] In FIG. **4**A, FIG. **4**B and FIG. **4**C, another fluid handling unit **400** is shown from three different views (top, front and side, respectively). In this embodiment, the fluid handling unit **400** has a first small fluid passage port **405** accessible by a first input orifice **410** and a first output orifice **415**; a second small fluid passage port **420** accessible by a second input orifice **425** and a second output orifice **430**; a first large fluid passage port **435** accessible by a third input orifice **440** and a first control orifice **445**; and a second large fluid passage port **450** accessible by a third output orifice **455** and a second control orifice **460**.

[0047] In one possible application of fluid handling unit **400**, fluid 'A' flows into first input orifice **410**, through first small fluid passage port **405**, and to first output orifice **415**. Fluid 'B' may flow into second input orifice **425**, through second small fluid passage port **420**, and to second output orifice **430**. Fluid 'C' may flow into third input orifice **440**, through first large fluid passage port **435**, and to first control orifice **445**. A control component may be reversibly coupled to the top of the fluid handling component **400** and may direct and regulate the flow of fluid 'C' from first control orifice **445** to second control orifice **460**. The control component may, for example, be a valve, a flow regulator, a pressure regulator, a restrictive flow orifice, a purifier, a flow controller, a filter, a gauge, a sensor, a branch connector and/or a mechanical indicator. The regulated flow of fluid 'C' may then flow through large fluid passage port **450** to third output orifice **455**. From third output orifice **455**, the fluid 'C' may be delivered, for example, to a piece of fluid utilizing equipment or possibly another fluid handling unit. Likewise, Fluids 'A' and 'B' may also be delivered, for example, to a piece of fluid utilizing equipment or possibly another fluid handling unit.

[0048] FIG. **5**A and FIG. **5**B show a top and a side view, respectively, of a modular fluid handling system **500** which includes the fluid handling units **200**, **300**, **400** from FIG. **2**C, FIG. **3**C, and FIG. **4**C coupled together to form a plurality of fluid flow passages, some small and some large. The fluid handling units **200**, **300**, **400** have been coupled together with gaskets **510**, **520** disposed between them to provide a leak tight seal for fluid communication between the orifices of the fluid handling units **200**, **300**, **400**. This embodiment **500** of a modular fluid handling system may be used to combine multiple streams of low-flow fluid streams into a singular high-flow stream, though other uses are possible within the scope of the invention.

[0049] In one example mode of operation, fluids 'D,' 'E' and 'F' may be input to fluid handling unit **400** through input orifices **440**, **410**, **425** respectively. A control component may be reversibly coupled with the top of fluid handling unit **400** and fluid 'D' may flow into the control component through control orifice **445**. The control component may regulate the flow of fluid 'D' and direct the regulated flow to control orifice **460**. Regulated fluid 'D' may then flow to fluid handling unit **300**. Meanwhile, fluids 'E' and 'F' may flow through fluid handling unit **400** and enter fluid handling unit **300**.

[0050] Another control component may be reversibly coupled with the top of fluid handling unit **300**. Fluid 'E' may enter the control component through control orifice **315** and be regulated and then redirected into control orifice **325**. Therefore, regulated fluid 'E' will be mixed into the fluid 'D' stream to make a 'D+E' stream. The 'D+E' stream may flow into fluid handling unit **200**. Meanwhile, fluid 'F' may flow through fluid handling unit **300** and enter fluid handling unit **200**.

[0051] Another control component may be reversibly coupled with the top of fluid handling unit **200**. Fluid 'F' may enter the control component through control orifice **230** and be regulated and then redirected into control orifice **250**. Therefore, regulated fluid 'F' will be mixed into the 'D+E' stream to make a 'D+E+F' stream. The 'D+E+F' stream may flow into fluid handling unit **200**. The 'D+E+F' stream may then exit the modular fluid handling system at output orifice **280** and possibly be delivered to a piece of fluid utilizing equipment. Those skilled in the will now realize that low pressure streams may be combined in such a manner with less of an increase in pressure that would occur had the streams been combined into a smaller port.

[0052] In some embodiments the modular fluid handling system **500** may be used to deliver a process, a purge, and a vacuum stream to a piece of fluid utilizing equipment. Fluid 'D' may be the process fluid and during normal operation fluid 'D' may flow to equipment as regulated by the control component coupled with fluid handling unit **400**. The control components coupled with fluid handling units **200**, **300** may be configured during this period of normal operation to completely prevent fluids 'E' and 'F' from entering the fluid 'D' stream and mixing therewith.

[0053] During a purge procedure, with fluid 'E' being the purge fluid, the control components coupled with fluid handling units **200**, **400** may be 'shut off' and prevent fluids 'D' and 'F' from flowing to the equipment. The control component couple with fluid handling unit **300** may then control the flow of the purge fluid to the equipment. Similarly, fluid 'F' may be a vacuum stream and while the control components coupled with fluid handling units **300**, **400** are shut off, the control component coupled with fluid handling unit **200** may control a vacuum stream delivered to the equipment.

[0054] FIG. **6** shows a side view of the modular fluid handling system shown in FIG. **5**A, except with a mass flow controller **610**, and two shut-off valves **620**, **630** also coupled with the system **600**. The simplified version of the mass flow controller **610** and shut-off valves **620**, **630** shown in FIG. **6** is merely for explanatory purposes and is not intended to be an exact representation of the precise structure or functionality of any particular commercially available control components. Mass flow controller **610** may be any mass flow controller known in the art and may be used to regulate the flow of fluid 'D' through the embodiment described above. The two shut-off valves **620**, **630** may be used to allow or not allow fluids 'E' and 'F' to flow into the large fluid passage formed by the fluid handling system **600**. Shut-off valve **620**, as shown, enables a user to turn on or off the flow of fluid 'E' into the large passage port, as shut-off valve **630** does for fluid 'F.' Gaskets are also shown disposed between the mass flow controller **610** and shut off valves **620**, **630** to provide a leak tight seal between the control components and the fluid handling units.

[0055] FIG. **7** shows an isometric view of another possible fluid handling unit **700** of the invention similar to that shown in FIG. **4**A, FIG. **4**B and FIG. **4**C, except having extensions with cavities on the front, back and top of the fluid handling unit that allow for reversible coupling of the fluid handling unit to other fluid handling units. As in FIG. **4**A, FIG. **4**B and FIG. **4**C, a first input orifice **410**, a second input orifice **425**, and a third input orifice **440** are visible on the front of the fluid handling unit **700**. A first control orifice **445** and a second control orifice **460** are visible on the top of the fluid handling unit **700**. Hidden from view in FIG. **7** are a first output orifice **415**, a second output orifice **430**, and a third output orifice **455**, which may be seen in better detail in FIG. **4**A, FIG. **4**B and FIG. **4**C.

[0056] Also shown on FIG. **7** are front attachment cavities **710**, **712**, **714**, **716**. Rear attachment cavities **720**, **722** are also shown. Two other similarly situated rear attachment cavities are present on the other side of fluid handling unit **700**, but are not visible from this perspective. Fasteners, for example bolts or machine screws, may pass through each of the front attachment cavities **710**, **712**, **714**, **716** and then through rear attachment cavities, similar to rear attachment cavities **720**, **722** on another fluid handling unit to reversibly couple the two fluid handling units together. Some or all of the attachment cavities may be threaded to facilitate the use of machine screws. In other embodiments, nuts may be used, and may be at least partially recessed into the cavities or coupled to the cavities. Other coupling methods may be employed such as cam-locking mechanisms or possibly chemical adhesives.

[0057] Further shown on the top of fluid handling unit **700** are top attachment cavities **730**, **732**, **734**, **736**. Control components which may be coupled with the top of the fluid handling unit **700** may have similarly situated attachment cavities. Fasteners, for example bolts or machine screws, may pass through each of the attachment cavities on the control components and into top attachment cavities **730**, **732**, **734**, **736** to reversibly couple the control component to the fluid handling unit **700**. Some or all of the attachment cavities may be threaded to facilitate the use of machine screws. In other embodiments, nuts may be used, and may be at least partially recessed into the cavities or coupled to the cavities. Other coupling methods may be employed such as cam-locking mechanisms or possibly chemical adhesives. FIG. **7** also shows recesses **740**, **742**, **744**, **750**, **752** around each of the orifices. mechanical seals may be disposed in these recesses to leak tightly couple adjacent fluid handling units.

[0058] FIG. **8** shows an isometric view of two of the fluid handling units **700** from FIG. **7** situated in an orientation **800** as they may be coupled together in some embodiments of the invention. In this orientation **800**, the two fluid handling units, having fluid passage ports similar to those in FIG. **4**A, FIG. **4**B and FIG. **4**C, have created multiple fluid passages. The two smaller fluid passages are accessibly by input orifices **410**, **425**. Three larger fluid passages are created: a first large fluid passage is accessible by input orifice **440** and control orifice **445** on the left fluid handling unit; a second large fluid passage is accessible by control orifice **460** on the left fluid handling unit and control orifice **445** on the right fluid handling unit; and a third large fluid passage is accessible by control orifice **460** on the right fluid handling unit and an output orifice which is not visible from this perspective. Control components could be coupled with the top of both fluid handling units to control and/or monitor the fluid flow through the large fluid passages.

[0059] Having described several embodiments, it will be recognized by those of skill in the art that various modifications, alternative constructions, and equivalents may be used without departing from the spirit of the invention. Additionally, a number of well known processes and elements have not been described in order to avoid unnecessarily obscuring the present invention. Accordingly, the above description should not be taken as limiting the scope of the invention.

[0060] As used herein and in the appended claims, the singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a process" includes a plurality of such processes and reference to "the unit" includes reference to one or more units and equivalents thereof known to those skilled in the art, and so forth.

[0061] Also, the words "comprise," "comprising," "include," "including," and "includes" when used in this specification and in the following claims are intended to specify the presence of stated features, integers, components, or steps, but they do not preclude the presence or addition of one or more other features, integers, components, steps, acts, or groups.

What is claimed is:

1. A modular fluid handling system comprising:

a plurality of fluid handling units, wherein adjacent fluid handling units are coupled together to form the fluid handling system, wherein the fluid handling system delivers fluid from at least one fluid source to fluid utilizing equipment; and

wherein a plurality of fluid passages are formed from the coupled plurality of fluid handling units, and wherein the diameter of at least one fluid passage is greater than the diameter of at least one other fluid passage.

2. The modular fluid handling system of claim **1**, further comprising:

at least one control component coupled with at least one of the fluid handling units.

3. The modular fluid handling system of claim **1**, wherein at least one fluid passage extends through the plurality of fluid handling units.

4. The modular fluid handling system of claim **1**, wherein at least one fluid passage is in fluid communication with at least one other fluid passage.

5. The modular fluid handling system of claim **4**, wherein the fluid communication occurs at least in part through the control component.

6. The modular fluid handling system of claim **1**, wherein a mechanical seal is disposed between adjacent fluid handling units to leak tightly couple adjacent fluid handling units together.

7. The modular fluid handling system of claim **1**, wherein at least one fluid passage is coupled with the fluid source.

8. The modular fluid handling system of claim **7**, wherein at least one other fluid passage is coupled with the fluid utilizing equipment.

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